Paper ID: VESCOMM 12

AN OVERVIEW OF INTELLIGENT TRAFFIC CONTROL SYSTEM USING PLC AND USE OF CURRENT DATA OF VEHICLE TRAVELS

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Abstract—**we know there is an evolution of atomization in technological field. So we have to use control system which works on digital data, where we have implemented a digital control through the PLC. The main work of PLC is to coordinate the functions required for controlling traffic light signals. We use the specified method for calculating the traffic density and send the signal automatically to PLC circuit and depending upon the priority, the controlling action for the traffic Signals are made. We use new timing scheme, and in accordance with it the signaling is implemented. This is implemented with more efficiently during the peak hours so as to use the data of sensor and to suitably control the traffic flow. The main work of the system is to check the status of sensors & sends the appropriate signal. The working of the system depends on the signal coming from sensor and the real time data provided with the priority as predecided. In such a way the overall PLC system works.**

Keywords:- PLC; Traffic Light Control, peak hours.

I. INTRODUCTION

Over time control system engineering has evolved greatly. In the past manual control was the only the form of control. More recently electrical control based on relays were used. These relays allow switching of power without a mechanical switch.PLC or a programmable logic controller is used to check and control a system using digital inputs which can be programmed for automation. The growth of PLC started in 1970s.The PLCs have become a major component of factory mainly because of the advantages they offer like

- Cost effective control for complete system
- Flexible and reusable
- Computational abilities
- Analytical power and decision making

The older system uses weight as a trigger mechanism. Current traffic systems react to motion to trigger the light changes. Once the infrared object detector picks up the presence of a car, a switch causes the lights to change .An adaptive traffic control system must have the ability to diagnose saturation conditions in the network and change the objective function as desired. In older fixed-time systems, there were multiple timing plans, but now a modern traffic control system can have multiple control strategies. We need to understand the function of traffic signals so that we can improve driving habits by controlling the speed in order to reduce the number of associated traffic accidents. The more number of drivers.

The Intelligent Traffic signal Control System consists of three important parts. The first part is the PLC controller and second part is hardware. These usually comprise of red, yellow, and green lights. The third part is the sensor. The sensors check the presence of vehicles.

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II. LITERATURE REVIEW

The basic PLC scheme includes memory, CPU, power supply, input block, output block, communication and expansion connections. Figure 1.2 shows the PLC system overview.
CPU modules - The Central Processing Unit (CPU) Module is the brain of the PLC and is used to read inputs, execute the control programs and update the outputs. The CPU consists of a arithmetic logic unit (ALU), timing and control circuitry, accumulator, address stacks, program counter and instruction registers. A PLC works by continuously scanning a program.
Memory - The memory includes pre-programmed ROM containing PLC's operating system, driver program, application programs and RAM. PLC manufacturers offer different types of retentive memory to save user programs and data while power is cut-off, so that the PLC can resume execution of the control program as soon as power is restored.
I/O Modules –The input and output (I/O) modules connect the PLC to the sensors and actuators and provide isolation for the low-voltage, low-current signals that the PLC uses internally from electrical circuits required by most sensors and actuators. A wide range of I/O modules are available including: digital (logical) I/O modules and analog (continuous) I/O modules.

A. Traffic Control System:-

- Traffic signals control vehicle movements
- Traffic Control Systems are interconnected with electronics system that controls traffic signals.

- Traffic Control Systems depend on logic which can be divided into these categories:
  i. The signal phases and cycle length are depend on the traffic flow on the desired track
  ii. The system responds to interrupts or timing base system and open the desired signal according to the priority requirement

B. Advantages Of A Good Traffic Control System

A properly ordered traffic control system can

1. Provide for orderly movement of traffic
2. Increase capacity at intersection
3. Reduce frequency and severity of certain kind of clashes
4. Provide continuous movement of traffic at a desired speed
5. Interrupt heavy traffic to allow pedestrians to pass
6. Effectively perform traffic management

using a generalized traffic control system fails to detect high priority situations or emergency conditions.Hence the need for a Smart Traffic Control System arises which would work on certain conditions and be able to take decisions automatically.

C . Disadvantages of Current Traffic System

Traffic signals are sometimes considered problems at intersections. In fact, traffic signals that are poorly located can adversely affect the safety and efficiency of vehicle, bicycle and pedestrian traffic. Improper or unjustified signals can result in one or more of the following:

- Significant increase in the frequency of some types of collisions
- Increased congestion, air pollution, and fuel consumption.
- Excessive delay.
- Excessive disobedience of the signal indications.
- Increased use of less adequate streets as motorists
- Attempt to avoid the traffic signals.
- Frustration especially in hot weather.

D . What Do You Mean By Intelligent Traffic Control?

Traffic Control Systems are used at a point where there are more than two paths for passage of vehicles or wherever passage is to be given to pedestrians to cross a road. It is also used wherever two paths cross each other thus creating a four-way lane. These systems are also put in place at points where there are by-lanes attached to the main road. The main aim of a traffic control system is to control the flow of vehicles through a lane and prevent accidents or road blockage. These systems are also used at points wherever a vehicle needs to be stopped for any purpose.

In our country the traffic control system is mostly based on sequential logic. There are three lights red for stop, yellow for get ready and green for go. Each light operates for a given period one after the other. The programming is so done that two lanes won't have the green light at the same time.

The traffic control systems at a certain places are even controlled manually by traffic personnel but human error calls for automation to prevent undesirable incidents on road.

The traffic signals control the vehicle movements. they are connected to electronics systems which control the signals. They mainly work on logics which can be classified as

a. signal phase and cycle length which is dependent on the traffic flow on the desired tracks.

b. system responds to interrupts or timing based system and open the desired signal as required .

E. What is plc?

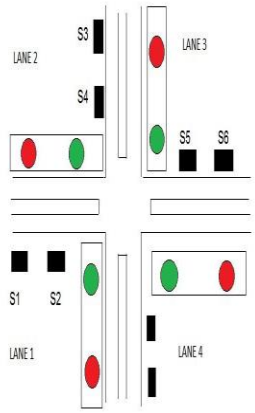
A Programmable Logic Controller (PLC) is an industrial computer control system that continuously monitors the state of input devices and makes decisions based upon a custom program to control the state of output devices.

In a PLC user enters a program, usually via software, that gives the desired results.

III. METHODOLOGY

In a practical design inductive loops are used as sensors to detect the presence of vehicles at intersections. Its basic function is to provide interrupts to control units. It has two parts, coil and a detector unit. Coil is main part of sensor and consists of more loops of wire embedded in the pavement. Inductive coil is connected to the detector unit which is an electronic circuit. When vehicles pass over or rest on the loop then due to induction more current flows through the loop and this causes change in frequency. Detector unit can detect these signals and then sends an interrupt signal to the control unit for further operation.

In prototype design Photo electric sensors are used, for prototype it is not possible to design an induction loop. As the basic function of induction loop in Intelligent Traffic Control System is used to provide an interrupt signal to controller unit. We use Photo electric sensors rather than induction loops. In our design, photo electric sensors provide an interrupt signal to controller unit. In case when vehicle reaches in front of sensors, then it provides an interrupt.



Traffic light model

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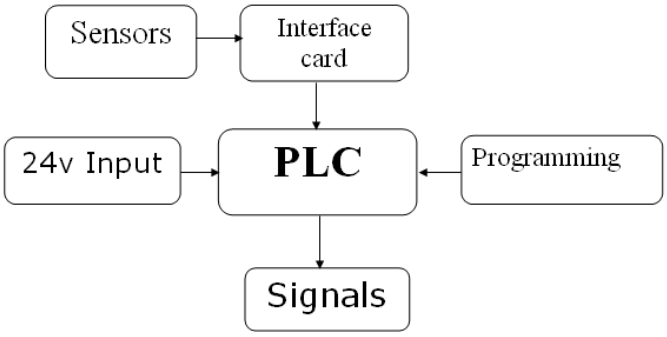

Fig. 2 System Block Diagram

A. Simulation

TRILOGI software has built in simulator engine. It is used without attaching the PLC hardware. This is the main advantage of the TRILOGI software. This type of feather is not used in other software.

B. Advantages of TRILOGI software

The main advantage of the TRILOGI software has it's built in simulator engine that provide us the facility to simulate the program any time without attaching the plc module. We check our all priorities, inputs, interrupts, timers, relays, counters and its output status in live condition. This is the big advantage of TRILOGI software.

- Test run of program off-line directly on the same pc that runs TRILOGY.
- Program can be distributed amount students to run that at home and test their logics without the need of PLC
- Remotely program, monitor, control and troubleshoot your super PLC controlled equipment via the internet at any time
- Remote software update
- PLC can e-mail specific reports at required time
- PLC can send SMS with just a single line of code

C. PLC SIMULATOR

- Trilogy has built in simulator engine which is in effect a "soft PLC"
- Great ease of program testing and debugging

D. Hardware Implementation

Hardware Components

1. PLC T100MD module
2. Interface card
3. Photoelectric Sensors
4. Signal poles
5. Communication Ports
6. Toggle Switches
7. Proto type hardware

PLC T100MD module

T100MD2424+ is a new member of the highly popular T100MD PLC family. The basic unit comprises 8 analog I/Os, 24 digital Inputs and 24 digital outputs. Two of the digital outputs (7 & 8) which can be also defined as PWM outputs can each deliver up to 10A peak and 2A continuous, 24VDC (active high) current to the load. The 8 analog I/Os are configurable as 8 AI, no AO or 6 AI and 2 AO. All analog inputs are 10-bit resolution and all analog outputs are 8-bit resolution. T100MD2424+ is expandable up to a total of 96 digital inputs and 96 digital outputs with an optional expansion module. It has an RS232 and an RS485 port. Both of them are conversant in MODBUS protocol. The built-in LCD port allows simple interface to industry standard LCD modules from 8 characters to 80 characters.

The compactly designed T100MD2424+ PLC can be easily installed in many kinds of plastic or metal enclosures. You need to use 4 or 5 PCB standoffs (or some screws and nuts) to support the controller and fasten it to a console box.

Analog I/O Ports: The 8 channels of analog I/Os are available via an 8-way detachable screw terminal connector along the left edge of the T100MD2424+ PLC. The PLC also supplies a +5V analog reference-voltage output.

Digital I/O Ports: Detachable screw terminals are provided for quick connection to all digital inputs, outputs and power supply wires. Each block of screw terminals can easily be detached from the controller body, enabling easy replacement of the controller board when necessary. Since the terminal block for digital I/Os are inserted vertically to the board surface, you need to remove the terminal block before you can start wiring. Use a small flat-head screw driver and insert underneath the terminal block, apply even pressure to raise the terminal block until it becomes loosened from the connecting-pin strip, as shown below: Al thou gh wires of up to 24 AWG may be connected directly to t he screw terminal, insulted crimp ferrules should be used to provide a good end termination to multithreaded wires. Use of ferrules reduces the possibility of stray wire-strands short circuiting adjacent terminals and their use is therefore highly recommended. The T100MD2424+ PLC requires a single regulated, 12 to 24V (+/- 5% ripple) DC power supply for the CPU and I/Os .It is recommended that whenever possible, use a higher power supply voltage since the voltage difference between ON and OFF state is wider for operation at higher voltage. To use the T100MD2424+ at 12VDC you should place a jumper block on the two-pin header marked "J1-12V" near the power supply terminals. You must remember to remove the jumper when operating the PLC above 18V. Otherwise the voltage regulator may overheat. Please use only industrial grade linear or switching regulated power supply from established manufacturers. Using a poorly made switching power supply can give rise to a lot of problems if the noisy high frequency switching signals are not filtered properly. If your application demands very stable analog I/Os you should choose a linear power supply instead of a switching power source for the CPU. Always place the power supply as near to the PLC as possible and use a separate pair of wire to connect the power to the PLC. Keep the power supply wires as short as possible and avoid running it along side high current cable in the same cable conduit. The T100MD-2424+ PLC will be reset when the power supply voltage dips.

E. Photoelectric Sensors

We use photo electric sensors for sensing the presence of the vehicle on the road. We use industrial based sensors has variable range that can be adjust by a variable knob at its surface. It has built in transmitter and receiver. This sensor works on PNP condition means that when object is placed in the range of sensor then it provides output. It has 3 output wires, one is used for input supply, and second wire is common between input and output. Third wire is used as output when object is detected.

F. System Study

This study has two main parts. First is study of PLC and the second part is its application intelligent traffic control system. The intelligent traffic control system has further divided into two main parts, Programming and hardware. Ladder logic Programming technique is used. PLC T100MD2424+ is used for attaching with proto type hardware. In hardware photoelectric sensors is used for sensing the presence the vehicles on the square in proto type.

IV. CONCLUSION

An intelligent traffic light system had successfully been designed and developed. The sensors were interfaced with Lab PLC Module. This interface is synchronized with the whole process of the traffic system. This prototype can easily be implemented in real life situations. Increasing the number of sensors to detect the presence of vehicles can further enhance the design of the traffic light system. Another room of improvement is to have the infrared sensors replaced with an imaging system/camera system so that it has a wide range of detection capabilities, which can be enhanced and ventured into a perfect traffic system.

ACKNOWLEDGMENTS

Submitting this report I would like to greafully acknowledge & Thanks to President our Institute Prof.G.K.Deshmukh & Principal Prof.S.M.Shaikh Sir, H.O.D & Staff of E& TC Dept. for their moral support and able guidance provided to us.

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